***TWO-STAGE AMPLIFIER CIRCUIT***

**INTRODUCTION - BJT**

* Bipolar Junction Transistor (BJT) is a semiconductor device that is made by having 3 doped substrates where the Base, Emitter, Collector is connected to The junction of Base to Collector is reversed bias while the junction of Base to Emitter is forward Bias for an NPN transistor. BJT has two uses which is as an amplifier and a switch.
  + We can use the BJT as an amplifier by biasing the BJT in such a way that its load line will be close to the middle to prevent the BJT from going to cutoff or saturation
  + We can use the BJT as a switch by biasing it close to the saturation or cutoff so that we can have only on or off signal on if there is voltage and off if there is not.

**INTRODUCTION – BJT CONFIGURATION**

* There are 3 configurations for a BJT and they are common base, common emitter, and common collector.
* Characteristics of **common base** is that it has a high voltage gain since input impedance is very small and it only has a current gain of 1 with an inphase output signal.
* Characteristics of **common emitter** is that it has a voltage gain of 1, a high input impedance, and lastly a high current gain with also an inphase output signal.
* Characteristics of **common collector** is that it has a high voltage gain and also a high current gain but the output signal would be out of phase by 180o relative to the input signal.
* **Cascaded amplifier** is when you try to series two or more transistor with their own following configuration.
* Advantage of cascaded amplifier is that they have high voltage gain since the total gain of the cascaded amplifier would be the product of each of the gain of the amplifier. Its drawback is that the more you cascade an amplifier the lesser the bandwidth would be.
* Cascaded amplifiers have different connection methods and they are **RC Coupling, Transformer Coupling, and Direct Coupling.**
* **RC Coupling** is when the connection of the collector in the first stage is connected to the base of the second stage by a coupling capacitor. It’s also the most commonly being used between two stage cascaded amplifier since they are inexpensive, very compact, and will prevent the DC biases of the two transistor to interfere with one another.
* **Transformer Coupling** is when instead of capacitors that will connect the first stage and second stage the one that would be used to connect will be the transformer. Its advantage is that it will result in a more efficient amplification since no signal power would be wasted in the inductor. Its drawback is that it’s going the heavy and expensive compare to an RC Coupling.
* **Direct Coupling** is when the first stage is directly connected on the second stage without any elements between them. This type of connection is essential if you only want to operate the amplifier in low frequency application like photoelectric current. Its drawback is that it’s not advisable to be use on high frequency and the DC biases of the two amplifier will interfere each other.

**METHODOLOGY**

The cascaded amplifier that we use is two BJT. Both has a voltage divider configuration and they are connected via RC coupling

The picture in the next slide will show you the exact schematic diagram of the circuit that we used. We used multisim to simulate our circuit we also provided the bode plot for our circuit.

Our amplifier has:

5 capacitors

8 resistances excluding the 8 ohm load

A VCC of 6 volts

2 NPN transistor in voltage divider configuration

We use a voltage divider configuration so that we can have a stable gain

We use RC coupling to prevent DC voltage of the two transistor from interfering one another.

**MATERIALS USED**

PCB Board

Capacitors and Transistors

Speaker

After dipping in ferric chloride etching

8 ohm Impedance

Materials Used

Case

Tools Used

Resistors

**DESIGNING**

* We use 8 resistors 5 capacitors and 2 NPN transistors just like the one in the schematic diagram on the multisim.
* We use this case to prevent the PCB from being damage unintentionally.
* We base the PCB design in our schematic diagram after making sure that it’s the same.
* We use this battery pack to provide the voltage we needed since one battery is insufficient.

**Results and Discussions**

* Our final output was based on the schematic diagram that we used in multisim the value of gain that we get is small compared to the one in multisim but it is still good since the drop is on reasonable levels.
* The result in our bode plot is that at 20 KHz the voltage gain is at 45.403 dB.